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# Notes

on

# Rubber Manufacture.

By

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*Chemist, Rubber Research Scheme, Ceylon.*

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# The Mildew Disease

in

# East Java.

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Results of the Mildew Inquiry made in 1927.

By

**G. A. REYDON,**

(From *Archief voor de Rubbercultuur*— October, 1927).

# Notes on Rubber Manufacture.

**T. E. H. O'BRIEN, M.Sc., A.I.C.,**

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## Sodium Silicofluoride as a Coagulant.

SODIUM silicofluoride (also known in trade circles as fluosilicic soda) is a greyish-white powder which occurs as a bye-product in the manufacture of superhosphates. It is used to some extent as an insecticide and also has fungicidal properties.

J. Edwardes,* Chemist to the Rubber Growers' Association in Malaya, experimented with S. S. F. as a preventive of mould in smoked sheet and noted that it was also a rubber coagulant. As regards mould prevention it was found that soaking sheets in a solution of S. S. F. prevented mould to a large extent, but it was less efficient for this purpose than para nitrophenol. The properties of S. S. F. as a coagulant were investigated and at the same time exhaustive tests were made by H. P. Stevens† to determine its effect on the inner properties of the rubber. The conclusion was reached that S. S. F. is a useful and economical coagulant without material influence on the inner properties of the rubber and its use was approved by the Rubber Growers' Association in 1925.

The method of use advised by the Rubber Growers' Association is as follows:

The latex should be diluted to 1½ lb. per gallon. The amount of S. S. F. required is 1 lb. to 150 gallons of diluted latex (i.e., 1 lb. to 225 lb. rubber). The weighed quantity of the chemical should be introduced into the coagulating tank and the diluted latex run in and thoroughly stirred.

* R.G.A. Bulletin. January, 1923. p.21.

† R.G.A. Bulletin September, 1925. p.555.

The advantages and disadvantages of S. S. F. as a coagulant are approximately as follows:

**Advantages.**

1. Being a non-corrosive solid it is easier to transport and handle than acetic or formic acid.
2. It is cheaper than Acetic acid.
3. It has certain fungicidal properties.
4. It has a remarkable influence in preventing bubbles in sheet rubber.

**Disadvantages.**

1. Being a solid it must be weighed instead of measured, which is probably less accurate under estate conditions.
2. It has a low solubility (0·84%) which means that it must be used in solid form or else as a very dilute solution.
3. It is a relatively weak coagulant, and therefore does not give complete coagulation unless the latex is diluted to $1\frac{1}{2}$ lb. per gallon.
4. It has a corrosive action on aluminium.

The properties of S. S. F. have also been carefully investigated by a number of workers in Java* and by N. H. Van Harpen in Sumatra.† The results reported from Java are much less satisfactory than those from Malaya, it being found that in many cases complete coagulation cannot be obtained even when the latex is diluted to $1\frac{1}{2}$ lb. per gallon, and that on the average the amount of coagulant required is more than twice that which is found to give satisfactory results in Malaya. It is also found that latex from various divisions of the same estate may behave differently on treatment with S. S. F. The reason for this was investigated by L. R. Van Dillen‡ who concludes that it is due to differences in the acidity of the original latex. The general conclusion reached in Java is that the use of S. S. F. is not to be recommended except in special cases for prevention of bubbles in sheet manufacture.

Results from Sumatra are more in line with those reported from Malaya, and the use of S. S. F. is recommended both as an economy and on account of its action in preventing bubbles in sheet. Van Harpen gives figures for an estate on which the proportion of off-grade sheet was reduced from 39% to 6·9% (average for 3 months) by adoption of S. S. F. It is pointed out that the use of the coagulant in powder-form is not to be recommended and that it should be made up in the form of a 0·5% solution. In this case it is claimed that coagulation at $1\frac{1}{2}$ lb. per

* Messrs. L. R. Van Dillen, C. Knaus, G. M. Kraay & R. Riebl. Archief Feb. 1928. p.127.

† Archief Dec. 1926. p.617, & Oct. 1927 p.487.

‡ Loc. cit.

gallon gives consistently satisfactory results. It has also been shown by the same worker that latex of 2 lb. per gallon can be satisfactorily coagulated if a small proportion of formic acid is added to the solution of S. S. F.

A few experiments were carried out by the Ceylon Rubber Research Scheme when S. S. F. was first introduced in Malaya. These laboratory tests indicated that S. S. F. in the proportion 1·200 gave good coagulation at $1\frac{1}{2}$ lb. per gallon leaving a clear or opalescent serum and that soaking sheets in a solution of S. S. F. after rolling, increased resistance to mould growth. It was thought however that a coagulant used in powder-form was not suited to Ceylon conditions and the investigation was not continued. Several enquiries were received on the subject a few months ago and it was thought advisable to make further tests to see whether S. S. F. could be used successfully in Ceylon. The experiments are not completed and the present notes are compiled with the object of giving the information which is at present available.

## Experiments on the Method of Using S. S. F.

The method recommended by the R. G. A. is that the required amount of the chemical should be introduced into the coagulating tank, and the standardised latex run in and stirred. This would be inconvenient in Ceylon where it is customary to coagulate in a number of Shanghai (50 gallon) jars.

The method adopted by the Sumatra and Java workers is to use the chemical in the form of a 0·5% solution. Approximately 8 gallons of solution is required to coagulate 1 jar of latex at $1\frac{1}{2}$ lb. per gallon, which would entail having a large mixing tank for the solution.

Tests were made in Ceylon to determine whether it would be satisfactory to add the chemical to the latex in the form of a suspension in water. S. S. F. "wets" readily and if it is first kneaded by hand with a little water it forms an even suspension when stirred up with the requisite quantity of water. This method of use gave good results in laboratory tests and two factory tests have been carried out. One test was made in the Kalutara district (approximate annual rainfall 150 inches), and the other in the Moneragalla district (approximate annual rainfall 80 inches), during wet weather.

Details of the tests were as follows:—

### A.—Kalutara District.

50 gallons of latex diluted to $1\frac{1}{2}$ lb. per gallon. $6\frac{1}{2}$ ounces of S. S. F. (i.e., 1 part S. S. F. to 180 parts dry rubber) was well mixed with 2 gallons of water and added to the jar of latex. The latex was stirred for 4 minutes and then distributed to enamelled coagulating pans.

The following morning coagulation in all pans was complete leaving a clear serum. The coagulum was somewhat softer than with a similar amount of Acetic acid, but worked up into good sheets.

**B.—Moneragalla District.**

50 gallons of latex diluted to 1 lb. 7½ oz. per gallon. 6½ ounces of S. S. F. mixed with 3 gallons of water and added to the jar of latex, stirred for 3 minutes and distributed to wooden troughs.

The following morning the coagulum was somewhat soft but worked up into good sheets. The serum was milky. A jar of the same latex coagulated with a similar quantity of Acetic acid gave a harder coagulum and a less milky serum.

It will be seen from the above results that coagulation was completely successful in one test but resulted in a small loss of rubber in the other test. This loss was probably not greater than is incurred daily in a number of factories using acetic acid, but was nevertheless unsatisfactory.

The value of a mixture of S.S.F. and acid for coagulation at 2 lb. per gallon was indicated by Van Harpen, and it is considered by the present writer that under Ceylon conditions it would be advisable to extend this to all coagulation with S. S. F. For sheet manufacture at 1½ lb. per gallon it is thought that S. S. F. in proportion 1·200 plus formic acid in proportion 1·1600 would give a coagulum of suitable hardness and a clear or opalescent serum.

The properties of latex vary on different estates and S. S. F. appears to be sensitive to such variations, so it would be necessary for each estate to establish by tests the proportion of S. S F and acid required to give satisfactory results.

## Influence of S. S. F. in Prevention of Bubbles in Sheet.

Up to the present two tests have been carried out to determine this point.

**A.—Laboratory Test.**

Latex brought in to the laboratories at noon was kept until 4 p.m. It was then diluted to 1½ lb. per gallon. One pan was coagulated by means of acetic acid (1·180) and the other by S. S. F. (1·180).

On examination after smoking it was found that the S. S. F. sample was entirely free from bubbles. The acetic acid sample contained numerous bubbles.

**B.—Factory Test in Moneragalla District.**

This Estate was visited for the purpose of advising on the cause and prevention of bubbles in smoked sheet. The bubbles were of the type usually attributed to premature clotting of the

latex and it was concluded that the trouble was chiefly due to climatic conditions.

Observations on the effect of S. S. F. in prevention of bubbles were made on the sheets obtained from the coagulation test described in the previous paragraph. It should be mentioned that latex for this experiment was taken from the field with the worst reputation for producing bubbly sheet. Both batches of sheet were coagulated in old wooden troughs.

One sheet from each batch was forwarded to the writer for examination. The S. S. F. Sheet was entirely free from bubbles and was very attractive in appearance. The Acetic acid sheet was badly disfigured with bubbles and would probably be valued at about 5 cents per lb. less in the local market. The Superintendent reported that these sheets were typical of the remainder.

These results confirm reports from Malaya and Sumatra that S. S. F. has a remarkable influence in preventing bubbles in sheet and the writer considers that this is one of the chief points in favour of S. S. F. as a coagulant. Unfortunately it has to be remembered that S. S. F. cannot be used in conjunction with aluminium pans and this would hinder its adoption on many estates.

## Coagulation of Latex at 2 lb. per gallon.

In crepe manufacture in Ceylon it is usual to coagulate at a dilution of 2 lb. per gallon. Coagulation with S. S. F. at $1\frac{1}{2}$ lb. per gallon would involve an increase of 33% in the number of jars for the same crop.

As mentioned earlier in the report Van Harpen has shown that coagulation at 2 lb. per gallon can be carried out successfully if a small proportion of the S. S. F. is replaced by acid. One test on these lines was carried out by the Writer with the following results.

| Nature of coagulant. | Appearance of serum (after 18 hours). |
|---|---|
| 1. Acetic acid (1·200) | Very milky. |
| 2. $\frac{7}{8}$ dose Acetic acid plus $\frac{1}{8}$ dose S.S.F. | Less milky than 1 (similar to 9). |
| 3. $\frac{3}{4}$ ,, ,, ,, ,, $\frac{1}{4}$ ,, ,, | Less milky than 2. |
| 4. $\frac{5}{8}$ ,, ,, ,, ,, $\frac{3}{8}$ ,, ,, | Opalescent. |
| 5. $\frac{1}{2}$ ,, ,, ,, ,, $\frac{1}{2}$ ,, ,, | Opalescent. |
| 6. $\frac{3}{8}$ ,, ,, ,, ,, $\frac{5}{8}$ ,, ,, | Opalescent. |
| 7. $\frac{1}{4}$ ,, ,, ,, ,, $\frac{3}{4}$ ,, ,, | Milky (similar to 3). |
| 8. $\frac{1}{8}$ ,, ,, ,, ,, $\frac{7}{8}$ ,, ,, | More milky than 7. |
| 9. S.S.F. (1·200) | More milky than 8 (similar to 2). |
| 10. S.S.F. (1·200) plus $\frac{7}{8}$ dose acetic acid. | Less milky than 9 (similar to 7). |

The test is not entirely satisfactory in that coagulation with acetic acid (1·200) gave a milky serum in this case. It indicates however that successful coagulation of latex for crepe manufacture is likely to be achieved by the use of S. S. F. in conjunction with a small quantity of acid, e.g., full dose of S. S. F. plus formic acid in proportion 1 to 1600. It is intended to carry out further tests on these lines as soon as tapping is resumed.

## Comparison of Coagulation Costs.

The latest quotations from Colombo for the various coagulants are as follows.

Acetic acid Rs. 19·00 per carboy of 45 lb.

Formic acid Rs. 18·00 per carboy of 45 lb.

S. S. F. (average of 2 quotations) Rs. 18·50 per cwt.

## Cost of Coagulating 100,000 lb. of Rubber.

| | | Saving compared with Acetic acid. |
|---|---|---|
| Acetic acid (1·200) | Rs. 211·10 | — |
| Formic acid (1·350) | ,, 114·30 | Rs. 96·80 |
| S. S. F. (1·200) plus Formic acid (1·1600) | ,, 107·60 | Rs. 103·50 |

## Conclusions.

1. Sodium silicofluoride has been used successfully as a coagulant in Malaya and Sumatra. Reports from Java are less satisfactory. Experiments indicate that it is likely to be a useful coagulant under Ceylon conditions when used in conjunction with a small proportion of acetic or formic acid.

2. Adoption of formic acid or sodium silicofluoride as a coagulant leads to a considerable reduction in the cost of coagulation.

3. Sodium silicofluoride has a remarkable influence in the prevention of bubbles (due to premature clotting) in sheet.

4. Sodium silicofluoride cannot be used in conjunction with aluminium utensils.

5. Further experiments are required in Ceylon, particularly with regard to the effect of S. S. F. on the colour of blanket crepe. Reports from Java indicate that the dose of sodium bisulphite can be reduced by 50%.

# Para Nitrophenol for Prevention of Fungal Spots in Crepe.

The use of para nitrophenol (p.n.p.) as a preventive of mould in smoked sheet is now well established in Ceylon, and it would be useful if it could also be employed for prevention of spots in crepe during manufacture and storage.

Spotting of crepe during drying can usually be traced to lack of ventilation in the drying rooms and should not occur even in unfavourable weather if the drying rooms are properly ventilated. The fact remains however that a number of Estates in Ceylon have trouble with fungal spots or surface mildew in crepe during the monsoons and there is no doubt that there is scope for an efficient disinfectant for use in crepe manufacture. Also in the present state of the rubber market it is necessary at times to store rubber for considerable periods, and in spite of careful manufacture spots are liable to develop if the rubber is stored under unfavourable conditions. The writer knows from experience that most of his crepe samples develop a good growth of fungal spots in the course of a year's storage at the laboratories.

H. C. Pinching* showed that soaking wet crepe in a 0·15% solution of p.n.p. prevented spotting and found that the treatment did not affect the colour of the crepe. A later recommendation of the Rubber Growers' Association† is that a 0·1% solution of p.n.p. should be used. Experiments in Ceylon indicate that soaking in 0·1% p.n.p. solution is effective but causes slight discoloration of the crepe. The degree of discoloration varies in different samples of latex but appears to be worst during wet weather which is when a disinfectant is most required. In comparing the results it should be remembered that crepe in Malaya is marketed in the form of "lace," and that slight discoloration which is not noticeable in lace crepe becomes evident when it is rolled into blanket.

W. Brown‡ investigated the causes of spots in crepe and found (in London) that soaking in a 0·01% solution of p.n.p. effectively prevented development of spots. Laboratory experiments in Ceylon indicate that this treatment does not entirely prevent spotting when the samples are kept in an atmosphere saturated with moisture, but would probably be effective under ordinary conditions of manufacture and storage. Unfortunately even this low concentration of p.n.p. leads to slight discoloration of blanket crepe. Moreover when the treatment was applied under estate conditions, viz: soaking 50 lb. of lace crepe in a Shanghai jar of solution it was found difficult to ensure thorough

* R.G.A. Bulletin, Sep. 1924. p.545.

† R.G.A. Bulletin, Sep. 1925. p.560.

‡ R.G.A. Bulletin, Nov. 1924. p.682. & R.G.A. Bulletin, Sept. 1925. p.522.

soaking, with the result that parts of the crepe were no more resistant to spotting than the untreated crepe.

The alternative method of using p.n.p. is to add it to the latex with the acid used for coagulation. Addition of 0·1% of p.n.p. (based on dry weight of rubber) prevents spotting but causes slight discoloration of the finished blanket. Experiments made recently indicate that ·025% of p.n.p. (i.e., 1 part p.n.p. to 4000 parts rubber) can be added to latex without having any effect on the colour of the rubber. In the latest experiment two chests of rubber were prepared from one batch of latex, one containing ·025% p.n.p. and the other without p.n.p. No difference in appearance could be detected, nor was there any streakiness when portions of treated and untreated crepe were blanketed together.

The resistance of the rubber to spotting was tested by keeping portions of wet lace crepe in an atmosphere saturated with moisture. The appearance of the samples after the test was as follows:—

**After 7 days.**

Control.—Many black and greenish spots.

Sample containing ·025% P.N.P. One yellow spot.

**After 18 days.**

Control.—Almost covered with black spots and surface mould.

Sample containing ·025% P.N.P. One yellow spot and some small pink spots.

The treatment was not sufficient to prevent spotting completely under this severe laboratory test but it is considered that it would be an effective preventive under normal conditions of manufacture and storage.

It remains to be seen whether this proportion of p.n.p. can be added to latex at all seasons without affecting the colour of the finished crepe, but anyone who is troubled with spotting of crepe is advised to experiment with this method of control.

The easiest way to incorporate the correct dose of p.n.p. in the latex is to dissolve the chemical in the undiluted acid (acetic or formic) used for coagulation. On the basis that one carboy (45 lb.) of acetic acid coagulates 9000 lb. of rubber the amounut of p.n.p. per carboy of acid is $2\frac{1}{4}$ lb. It is advisable to empty the contents of the carboy into a Shanghai jar, mix in the chemical and then replace the acid in the carboy. If mixed in bulk in this way there is little danger of mistakes in the amount of p.n.p. added to the latex. Alternatively a 1% solution of p.n.p. in water can be made by dissolving 1 lb. p.n.p. in 10 gallons of water and the correct dose added to the diluted acid used for coagulation. Coagulating at 2 lb. per gallon the dose for a 50 gallon jar would be 2 pints.

# The Mildew Disease in East Java.

## Results of the Mildew Inquiry made in 1927.

**G. A. REYDON,**

(*From "Archief voor de Rubbercultuur"*—October, 1927).

## Introduction.

IN the beginning of this year an inquiry was made regarding the increase of mildew disease in the rubber of East Java.

The results of this inquiry are shown in this paper.

It appears from the inquiry that on 70 of 105 estates the mildew disease has considerably increased during 1925 and 1926, as compared with previous years.

## General Review.

From the general review (*vide* page 436) it appears that about 95 per cent. of the total number of rubber estates, suffered in a greater or lesser degree from mildew disease.

In East Java the increase of the disease is considerably larger than in West-Java, where as yet not one half of the total rubber estates have reported mildew.

## Detailed Review.

From the review on page 437 it appears that on 48 per cent. of the total estates on which mildew was stated, the attacks of the disease had been severe.

Of the remaining 52 per cent. of the total estates, where the disease is less in evidence, there were 27 estates (=21·6 per cent.) which had only sporadical cases of mildew.

According to answers, the disease also appeared on the seed and budding beds of 17 per cent. of the 'mildew estates'. Since the yellow mite (*Tarsonemus translucens*) had had free play, especially during the last year, on nearly all the nurseries, and the attacks of this insect appear much the same as mildew infection, the said percentage can, for a great part, be accounted to the attacks of the said insect.

At last it appears from this review that on 13 per cent. of the mildew estates the attacks were limited to definite complexes, so that on the greater part of the estates the disease spread over whole areas.

## Wintering.

The beginning of the wintering, or rather the season during which the new leaves and blossom of the *Heveas* appear, confines the susceptibility to the mildew, because full grown and strong leaves are seldom attacked.

There are indications, that during the period in which the mildew mould (*Oidium Heveu*) is under the most favourable circumstances, all trees, strong as well as weak specimens, which have young leaf at the same time, are liable to be attacked by this disease.

According to further reports from estates, which suffered heavily from mildew, this period falls about the middle of the East monsoon (August and September). It follows from this, that trees, which have young leaf during a period when the mildew does not appear or is less virulent, will be either not, or less severely attacked.

From the reviews respecting the wintering reports, it appears indeed, that estates, where most *Heveas* winter about July and hence one till two months after (that is August and September) will be in the time of young leaf, have suffered more from the disease than estates where the leaf-fall is earlier (about April and May).

To procure young trees for the future which will be less susceptible to attacks from mildew, it will be as well to choose mother-trees which winter every year regularly at the same time, as far as possible during the end of the West monsoon (February-March) or the end of the East monsoon (October-November).

## Further Communications Mentioned in the Inquiry.

It appeared that the practical information was contradictory.

The information showed a few indications of a possible influence of the dry season, in which the severe droughts of the past two years were chiefly responsible for the virulent attacks of mildew.

## Rainfall Figures.

The average rainfall figures were taken from 60 mildew estates which had little or no mildew.

It appears that during the dry months, May till October, *less* rain fell on mildew estates, than on those estates which had no mildew or only sporadic cases.

The rainfall figures from so many different estates show, however, such variations that an average figure cannot be taken as a definition of the true conditions.

The rainfall figures were, therefore, again compared from 7 pairs of neighbouring estate, where one estate continually suffered severely and the other slightly from mildew attacks.

It was found, save in one exception, that on the mildew estate notably less rain fell than on the neighbouring estate, which had no or only sporadic cases of mildew.

To conclude herefrom, that more rain means less mildew is, in our opinion, rash, because we do not know exactly the nature of the influence of the rain on mildew-attacks and we must first find out when the young leaf period falls.

The mildew attack is indeed, in the first place, dependent on this last factor.

## Geographical Spreading of Mildew.

It was seen from the reports that nearly all low-lying estates suffered more from mildew than high-lying estates, also in many cases the *Heveas* of estates lying on the east slopes of mountains were attacked less than those of estates lying on the south slopes.

The two estates in Borneo which also came into the East Java inquiry were, although low-lying, still free from the disease.

## Graphs from Bandjarsarie Estate.

The manager of this estate has given us graphs of the rainfall, rubber production, wintering and mildew attacks, over the year 1924—1925—1926. The wintering and mlidew graphs show :—

For 1924.—A quick wintering and at the same time a short but severe attack of mildew in July and August.

For 1925.—A long wintering, and at the same time a longer attack of the disease which culminated definitely in July and August.

For 1926.—A shorter wintering than in 1925 and a mildew attack that was at its height in August and September.

The most important point, in our opinion, that is shown by the wintering and mildew graphs, is that the mildew came *suddenly* and vigorously to an outbreak (in July or in August), in spite of the fact that the wintering, and thus the number of trees susceptible to mildew, slowly increased from April.

Further that in and after October few or no trees were again attacked by mildew.

From the graph on page 453 can be seen that the total rubber production from 1924 till 1926 have increased.

As regards the rainfall-graphs (in connection with the mildew) the mildew attacks were severest during the abnormal dry year of 1925. In 1924, however, in which year was the heaviest rainfall, the mildew attacks were weakest. In 1926 the rainfall was heavier than in 1925 and less than in 1924, while the mildew attacks in 1926 were less than those in 1925 and more than in 1924.

## Summary of the Results of the Inquiry.

1. The mildew disease has become considerably worse during the last few years, as compared to previous years.

2. Mildew has appeared on nearly all East Java estates.

3. The attacks of the disease has been severe on 48 per cent. of the total mildew infected estates.

4. Mildew has appeared on the budding-beds or nurseries of 17 per cent. of the estates.

5. Dying off of twigs was accounted to mildew by 37·6 per cent. of the managers of the diseased estates.

6. Decrease of production was accounted to mildew attacks on 6·4 per cent. of the "mildew estates."

7. Mildew taken over a whole, is not limited to definite complexes, but spread over whole areas.

8. In the district under observation of the Malang Experimental Station it is asserted that the trees which winter later in the East monsoon (about July) are attacked more severely than those which winter early (about May). It is this factor which must be remembered when approving plant-material.

9. The rainfall on mildew estates during the East monsoon was less than on "healthy estates".

10. Mildew is considerably worse on low-lying than on high-lying estates, and again more severe on the South than on the Eastern slopes of the hills.—*The Planters' Chronicle.* Vol. XXII. No. 53. December, 1927.

# NOTICES.

## SUBSCRIPTIONS.

Arrangements have now been made for Bulletins of the Ceylon Rubber Research Scheme to be made available to non-contributors to the Scheme at the rate of Rs. 15-00 per annum, post free.

## OFF-COLOURED CREPE.

The Chemist to the Rubber Research Scheme would be glad to get into touch with the Superintendent of any estate who is troubled with off-colour crepe, and who thinks that this may be due to impurities in the water used for manufacture.

## GLASS METROLOCS.

Glass Hydrometers for testing latex as specified and as recommended by the Rubber Research Scheme (Ceylon) may be obtained at a cost of Rs. 12-50 each from :—

Messrs. WALKER, SONS & Co., Ltd.,
Engineering & Estate Supplies Department,
Colombo.